4.8 NOISE

This section discusses the potential noise impacts that may result from demolition, construction, and operation of the Project.

4.8.1 ENVIRONMENTAL SETTING

Terminology and Fundamentals of Environmental Acoustics

The decibel (dB) is the preferred unit used to measure sound levels utilizing a logarithmic scale to account for large range in audible sound intensities. A general rule for the decibel scale is that a 10-dB increase in sound is perceived as a doubling of loudness by the human ear. For example, a 55-dB sound level will sound twice as loud as a 45-dB sound level. The average healthy person cannot detect differences of 1 dB whereas a 5-dB change is noticeable to most.

Several sound measurement descriptors are used to assess the effects of sound on the human environment. These include the equivalent continuous sound level, Leq, which is the level of a constant sound that has the same acoustic energy as the actual fluctuating sound. It is similar to the average sound level. The day-night average sound level (Ldn), is similar to the 24-hour Leq except that a 10-dB penalty is added to sound levels between 10 p.m. and 7 a.m. to account for the greater sensitivity of people to sound at night. The Community Noise Equivalent Level (CNEL) additionally places a 5-dB penalty on sound occurring in the evening hours.

Acoustics is defined as the science of sound, including the generation, transmission, and effects of sound waves, both audible and inaudible. Noise, on the other hand, is generally defined as unpleasant, unexpected, or undesired sound that disrupts or interferes with normal human activities. Although exposure to high noise levels has been demonstrated to cause hearing loss, the principal human response to environmental noise is annoyance. The objectionable nature of sound is caused by its pitch and loudness. Pitch is a subjective response to the frequencies making up the sound. Higher pitched signals (higher frequencies) sound louder to humans than sounds with a lower pitch. Loudness is a subjective response of the human ear to the intensity of sound waves. Sound intensity reflects the rate with which the acoustic energy is being transmitted and is a measure of the amplitude or height of the sound wave. Frequency describes the sound’s pitch and is measured in Hertz (Hz), while intensity describes the sound’s loudness and is measured in dB.

The dB is the preferred unit for measuring sound that indicates the relative amplitude (height) of a particular sound wave. The zero (0) on the decibel scale is based on the lowest sound level that a healthy, unimpaired human ear can detect. The A–weighted decibel (dBA) is a method of sound measurement which assigns weighted values to selected frequency bands in an attempt to reflect how the human ear responds to sound. The range of human hearing is from 0 dBA (the threshold of hearing) to about 140 dBA which is the threshold of pain. Examples of noise and their A–weighted decibel levels are shown in Table 4-42. In general, a 3- to 5-dBA change in community noise levels starts to become noticeable, while 1- to 3-dBA changes are generally not perceived. Quiet suburban areas typically have noise levels in the range of 40–50 dBA, while those along arterial streets are in the 50–60 dBA or greater range. Normal conversational levels are in the 60–65 dBA ranges. The C-weighted decibel scale (dBC) was originally developed to reflect the frequency sensitivity of the human ear to high sound levels (above 85 dB). However, currently, the C-weighting is almost exclusively used to assess the low frequency content of sound, often in combination with the A-weighted scale. C-weighting is generally flat, and thus includes more of the low-frequency range of sounds.

In addition to the actual instantaneous measurements of sound levels, the duration of sound is important since sounds that occur over a long period of time are more likely to be an annoyance or cause direct physical damage or environmental stress. To analyze the overall noise levels in an area, time-varying noise is averaged over a specific time period in a way that represents the same acoustic energy as the time-varying noise. Such average is referred to as equivalent continuous sound level and represented by Leq. Statistical sound levels, Ln, are also frequently used as environmental noise descriptors. The subscript n denotes the percentage of time that the noise level is exceeded during the measurement period. Common levels in environmental acoustics are L10, L50, and L90. L10 indicates the sound level that is exceeded 10 percent of the time and is generally taken to be indicative of the highest noise levels experienced at the Project Site. Construction noise criteria are often based on L10. The L90 is the level exceeded 90 percent of the time and this level is often called the base or background level of noise at a location. The L50 sound (that level exceeded 50 percent of the time) is frequently used in standards and ordinances dealing with traffic noise.

The scientific instrument used to measure noise is the sound level meter. Sound level meters can accurately measure environmental noise levels to within ±1 dBA. The data is then imported into computer sound models. These computer models are used to predict environmental noise levels over a given area. The accuracy of the predicted models depends on the accuracy of the noise sources data, the distance from the source to receptor, atmospheric conditions, and ground representation and its effective attenuation. The closer to the noise source, the greater is the model’s accuracy.

Table 4-41 defines technical terms that are used in this document.

Table 4-41 Definitions of Acoustical Terms

Terms	Definitions
dB, Decibel	Unit of measurement of sound level
dBA, decibel A-Weighted	A unit of measurement of sound level corrected using the A–weighting network (scale), as defined in Amercian National Standards Institute, Inc. ((ANSI) S1.4–1971 (R1976), using a reference level of 20 micropascals (0.00002 Newtons per square meter).
A – Weighted Scale	A frequency weighting scale, which corrects the sound pressures in individual frequency bands according to human sensitivities. The scale is based upon the fact that the region of highest sensitivity for the average ear is between 2,000 and 4,000 Hz.

Terms	Definitions
	Sound levels are measured on a logarithmic scale in decibels, dB. The universal measure for environmental sound is the A–weighted sound level, dBA.
C—Weighted Scale	A frequency weighting scale which currently is most commonly used to assess the low frequency noise component of environmental sound. The scale of C-weighting is generally flat, and thus includes more of the low-frequency range of sounds.
Hz, Hertz	Unit of measurement of frequency, numerically equal to cycles per second.
Loudness	A listener's perception of sound pressure incident on his ear.
L01, L10, L50, L90	The A–weighted noise levels that are exceeded 1 %, 10 %, 50 %, and 90 % of the time during the measurement period.
Leq, Equivalent Noise Level	Also, called the equivalent continuous noise level. It is the continuous sound level that is equivalent, in terms of noise energy content, to the actual fluctuating noise existing at the location over a given period, usually one hour. Leq is usually measured in hourly intervals over long periods in order to develop 24–hour noise levels.
CNEL, Community Noise Equivalent Level	The CNEL is a measure of the cumulative noise exposure in the community. This noise descriptor represents the noise level averaged over a 24–hour period with penalties applied to the evening and nighttime noise levels when residents are more sensitive to intrusive noise. The daytime period is from 7:00 a.m. to 7:00 p.m.; evening from 7:00 p.m. to 10:00 p.m.; and nighttime from 10:00 p.m. to 7:00 a.m. No penalty is applied to the measured day levels defined as 7:00 a.m. to 7:00 p.m. A 5-dB penalty is applied to the evening levels (7:00 p.m. to 10:00 p.m.) and a 10-dB penalty is applied to the nighttime levels (10:00 p.m. to 7:00 a.m.).
Ldn, Day/Night Noise Level	The same as CNEL except that the evening time period is not considered separately, but instead it is included as part of the daytime period. Measurements of both CNEL and Ldn in the same residential environments reveal that CNEL is usually slightly higher (usually less than 1 dB) than Ldn due to the penalties applied during evening hours.
Lmin, Lmax	The minimum and maximum A–weighted noise level during the measurement period.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

Effects of Noise

Hearing Loss

While physical damage to the ear from an intense noise impulse is rare, a degradation of auditory acuity can occur even within a community noise environment. Hearing loss occurs mainly due to chronic exposure to excessive noise, but may be due to a single event such as an explosion. Natural hearing loss associated with aging may also be accelerated from chronic exposure to loud noise.

The Occupational Safety and Health Administration (OSHA) has a worker noise exposure standard, which is set at the noise threshold where hearing loss may occur from long–term exposures. The maximum allowable level is 90 dBA averaged over an eight (8)-hour time period.

Sleep and Speech Interference

The thresholds for speech interference indoors are 45 dBA if the noise is steady and 55 dBA if the noise is fluctuating. Outdoor thresholds are 15 dBA higher. Steady noise of sufficient intensity (above 35 dBA), and fluctuating noise levels above 45 dBA have been shown to affect sleep. Interior residential standards for multi–family residences are set by the State of California at 45 dB Ldn. Typically, the highest steady traffic noise level during the daytime is equal to the Ldn, and nighttime levels are generally 10 dB lower. The standard is designed for sleep and speech protection and most jurisdictions apply the same criterion for all residential uses. Typical sound attenuation for residential building walls is 12–17 dB(A) with open windows. With closed windows in good condition, the noise attenuation factor is 20 dB(A) for older structures and 25 dB(A) for newer structures. Sleep and speech interference is therefore possible when exterior noise levels are 57–62 dB Ldn with open windows and 65–70 dB Ldn if the windows are closed. Levels of 55–60 dB are common along collector streets and secondary arterials, while 65–70 dB is a typical value for primary and major arterials. In order to achieve an acceptable interior noise environment, bedrooms facing secondary roadways need to be able to have their windows closed and those facing major roadways and freeways typically need special glass windows.

Annoyance

Attitude surveys are used for measuring the annoyance felt in a community for noise intruding into homes or affecting outdoor activity areas. In these surveys, it was determined that the causes for annoyance include interference with speech, radio, and television, house vibrations, and interference with sleep and rest. The Ldn as a measure of noise has been found to provide a valid correlation of noise level and the percentage of people annoyed. When measuring the percentage of the population highly annoyed, the threshold for ground vehicle noise is 55 dB Ldn. At an Ldn of 60 dB, 7.7 percent of the population is highly annoyed. When the Ldn increases to 70 dB, the percentage of the population increases to 24 percent highly annoyed. This corresponds to an average increase of 1.6 percent per dB between an Ldn of 60–70 dB.

People appear to respond more adversely to aircraft noise as opposed to general community noise levels. When the Ldn is 60 dB; approximately 10 percent of the population is highly annoyed. Representative outdoor and indoor noise levels in units of dBA are shown in Table 4-42.

Table 4-42 Typical Sound Levels Measured in the Environment

At a Given Distance from Noise Source	A–Weighted Sound Level in dBA	Noise Environments	Subjective Impression
	140		
Civil Defense Siren (100')	130	Rock Music Concert	
Jet Takeoff (200')	120		Pain Threshold
	110		
Diesel Pile Driver (100')	100		Very Loud
	90	Boiler Room Printing Press Plant	
Freight Cars (50')			
Pneumatic Drill (50')	80		
Freeway (100')	70	In Kitchen with Garbage Disposal Running	Moderately Loud
Vacuum Cleaner (10')			
	60	Data Processing Center	
Light Traffic (100')	50	Department Store	
Large Transformer (200')			
	40	Private Business Office	Quiet
Soft Whisper (5')	30	Quiet Bedroom	
	20	Recording Studio	
	10		Threshold of Hearing
	0		

Fundamentals of Ground Vibration

The ground vibration can be defined as oscillatory displacement of the ground as a result of a disturbance (excitation) from vibration source. The disturbance propagates away from the source by means of vibration waves. The main vibration waves are the: "primary" or "compression" waves (P-waves), "secondary" or "shear" waves (S-waves), and Rayleigh waves (R-waves). The first two waves are called "body waves". The third one is a type of a surface wave as it is confined to a zone near the surface. The motion of ground particles associated with a P-wave is the back and forth movements along the direction of the wave travel. The motion of ground particles associated with an S-wave is in a direction transverse to the direction of the wave. For R-waves, the motion of ground particles has both horizontal and vertical components and these movements attenuate rapidly with depth. Since Rayleigh waves are confined to a narrow zone along the surface of the ground, they tend to carry more energy and do not attenuate with distance as much as the P-waves or S-waves. The main properties of ground vibration are the vibration amplitude – the maximum displacement and the vibration frequencies.

Ground vibration can induce vibration of buildings and structures that it supports. Construction as well as traffic induced vibration in buildings can be a common source of annoyance affecting residents and in some cases, can degrade the performance of precision measuring equipment (MRI, etc.). Any perceptible vibration from extraneous sources tends to result in residential concerns about possible building (structure) damage, even when the associated amplitudes of vibration are much, much lower than those barely sufficient to cause superficial damage such as cracks stucco or drywall. Also, vibration below the threshold of perception can affect people through their sense of hearing if causes airborne noise from rattling objects or building surfaces. Traffic (including heavy trucks) on major highways, rarely generates vibration amplitudes high enough to cause any type of structural or cosmetic damage and in most instances the resulting vibrations would not be perceptible. Traffic along secondary roadways closer to residences where vehicles travel over potholes or other discontinuities in the pavement can induce high enough vibration levels to result in complaints from the residents. Freight trains and light-rail trains can also be significant sources of ground vibration.

Most construction and traffic induced vibration involve sources of vibration at or near the surface, making the R-waves the primary waves of concern. Even when the actual vibration sources are below the surface (e.g., pile driving) R-waves form at the surface within a short distance from the location of the source. Therefore, propagation of vibration from construction or traffic sources is typically modeled assuming R-waves. Vibration can be continuous or transient. According to the California Department of Transportation (Caltrans) Vibration Guidance Manual (2013a), the following vibration sources result in the continuous vibration:

- excavation equipment,
- static compaction equipment,
- tracked vehicles,
- traffic on a highway,
- vibratory pile drivers,
- pile-extraction equipment, and
- vibratory compaction equipment.

Transient and low-rate repeated vibration may result from the following activities:

- impact pile drivers,
- blasting,
- drop balls,
- “pogo stick” compactors, and
- crack-and-seat equipment

The effects of vibration on people or structures is primarily a function its amplitude and frequency. The typical frequency range of interest in ground and building vibration is from 1 to 80 Hz. Most of construction and traffic induced vibration occurs in the frequency range of 10 to 30 Hz. Single-number vibration amplitude limits for construction are generally set assuming the corresponding vibration frequencies are between 10 and 30 Hz.

The ground and building vibration can be measured directly using velocity transducers or accelerometers. The most common descriptors for ground and building vibration amplitude is the peak particle velocity (PPV) and peak particle acceleration (PPA) defined in inches per second (in/s) and inches per second squared (in/s^2), respectively. Similarly, to noise, the amplitude of vibration is also commonly expressed in decibels. The most common descriptors here are the vibration velocity level (L_v) and vibration acceleration level (L_a).

In this document only construction vibration is considered. The criteria for vibration are set using the PPV as a descriptor.

4.8.1.1 Existing Conditions

Sensitive Receptors and Existing Noise Environment

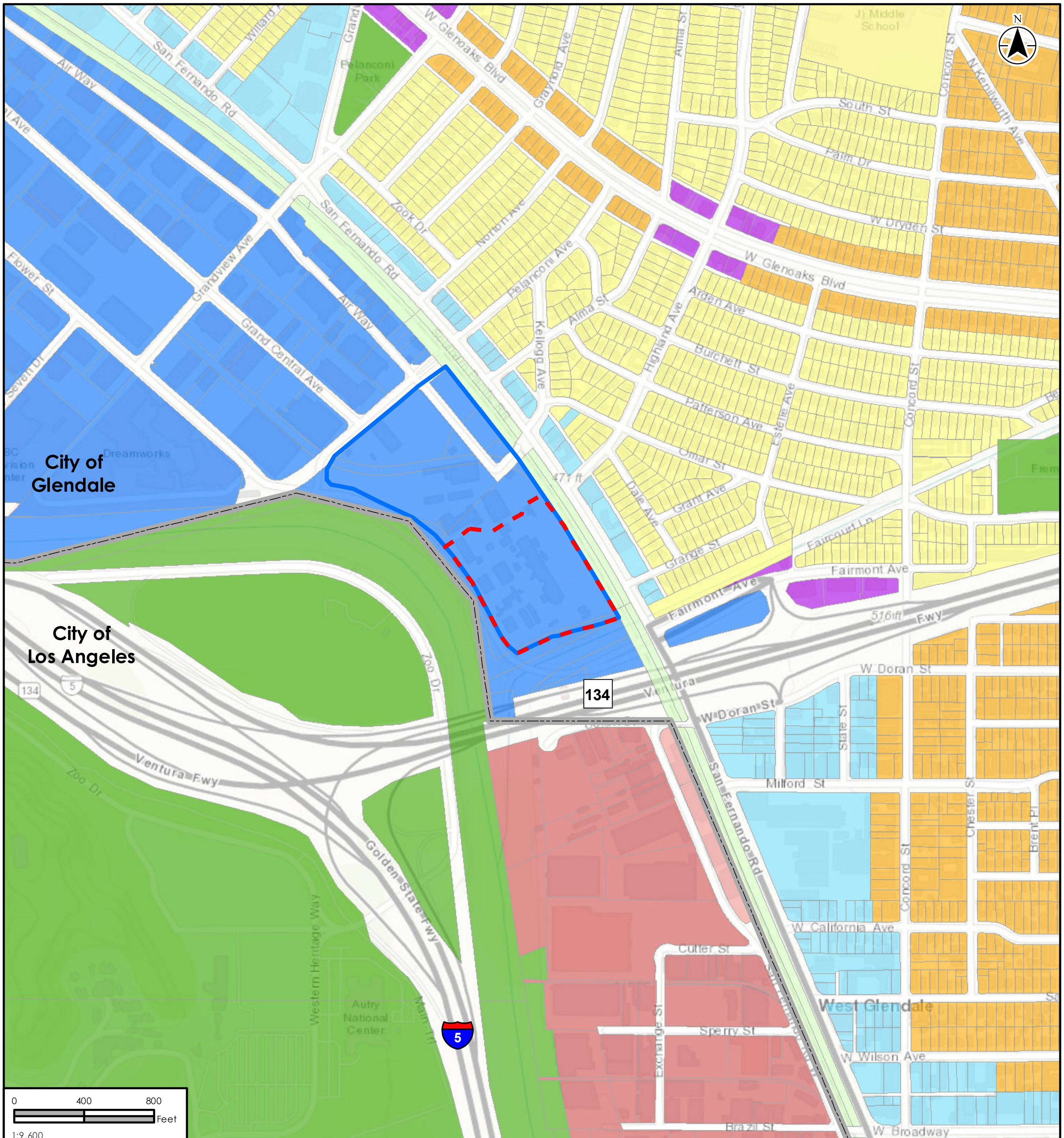
Some land uses are recognized as being more sensitive than others to noise levels and vibration. Residences, motels and hotels, schools, libraries, houses of worship, hospitals, nursing homes, auditoriums, parks, and outdoor recreation areas are generally more sensitive to noise and vibration than are commercial and industrial land uses. The land use of the Project site is industrial and is adjacent to other industrial, and recreation land uses. There is also a low density residential area nearby. This area is located more than 430 feet from the Project boundary and is separated from the Project site by the railroad tracks, roadways, and intervening commercial uses.

The Project site is bounded to the north by the Utility Operations Center, east by a Los Angeles METRO rail line and San Fernando Road, west by the Los Angeles River and John Ferraro Athletic Fields, and to the south by Verdugo Wash. Interstate 5 is located adjacent to the John Ferraro Athletic Fields and State Highway 134 is located adjacent to the Verdugo Wash. The land use designation and zoning of the Project site and surrounding area are shown in Figures 4-8 and 4-9.

The primary noise sources in the Project area are the traffic on adjacent roadway/highways, trains on the adjacent railway, and operation of industrial land uses including the Grayson Power Plant.

Although noise levels at sensitive receptors to the Grayson Power Plant are primarily influenced by vehicle traffic on San Fernando Road, existing operation of the Grayson Power Plant also contributes to these ambient noise levels. Many of the power generation noise sources associated with the current operation of the Grayson Power Plant would be removed during the demolition phase of the Project and replaced with other power generation equipment related noise sources. Basing Project predicted noise levels plus ambient noise levels that included sources that would be removed as part of the Project, would result in overestimating potential noise impacts. In an effort to remove this interference to the noise impact analysis, the collection of ambient noise measurements was coordinated to coincide when none of the existing power generation units were in operation. Although none of the power generation units were in operation when ambient noise levels at nearby receptors were measured, some ancillary equipment at Grayson that emitted noise remained in operation. These sources included a cooling tower, air washer, air preheater, compressor, vapor extractor, oil pump, turbine gear/decks and fans. These sources will be removed as part of the Project and will no longer contribute to noise. Correspondingly, the noise contributions from these sources were removed from the measured ambient sound levels.

Document Path: U:\2057\2057123300\mxd\fig_3_7-1_Land_Uses_in_Project_Vicinity.mxd



Legend

Grayson Power Plant Facility Boundary
Utility Operations Center Boundary

Land Use Type

Educational Institutions
Extraction
Heavy Industrial
Local Parks and Recreation
Mixed Urban
Multi-Family Residential
Other Commercial
Recreation/Open Space
Retail Stores and Commercial Services
Single Family Residential

Stantec

Grayson Repowering Project

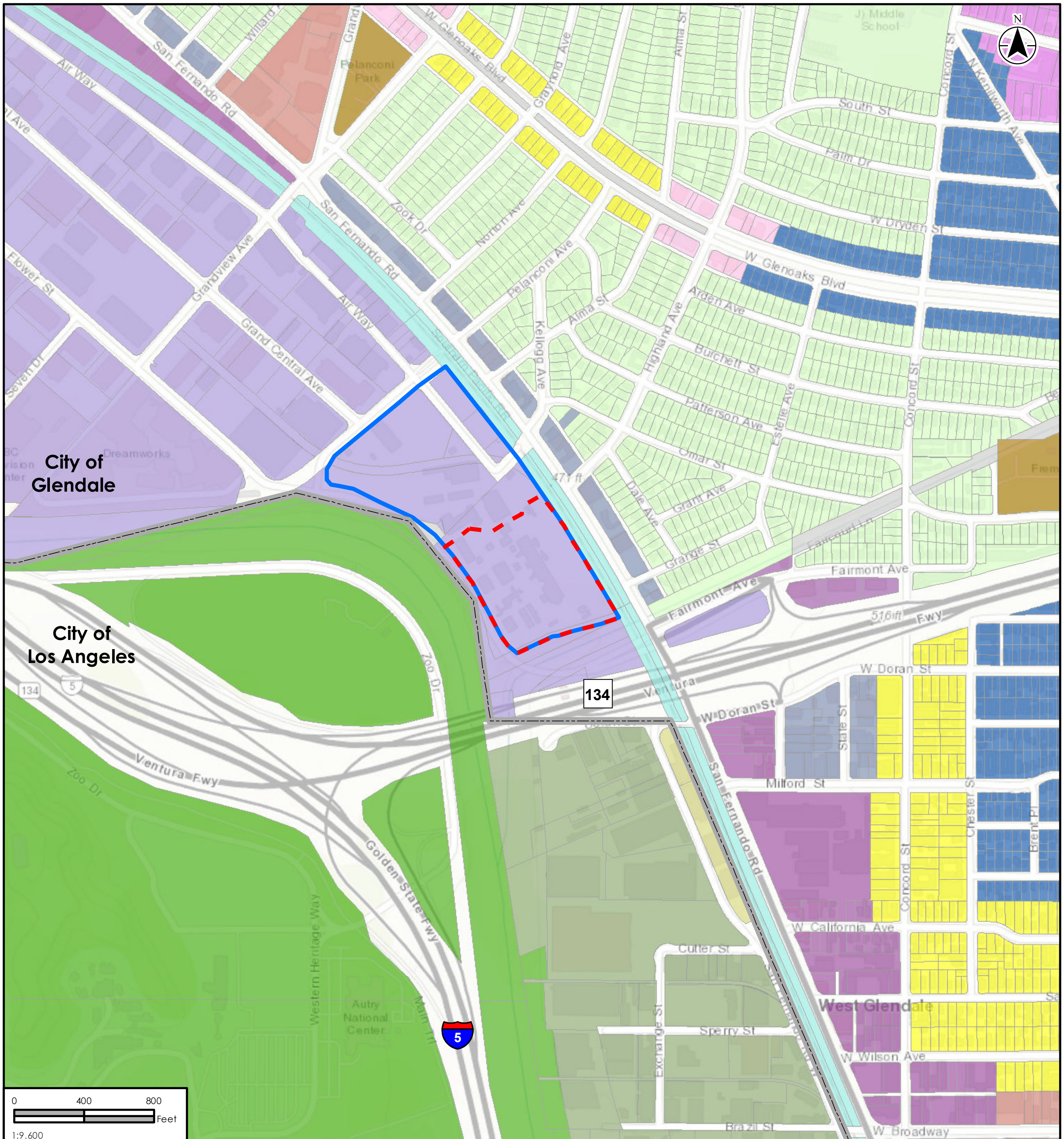
Notes:
1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
2. Park Data- Los Angeles County GIS Database 2017

Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.

Figure 4-8
Land Uses in the Project Vicinity

Prepared: JTrook, 6/12/2017, Technical Review: MW, Independent Review, SR

Document Path: U:\2057\2057123300\mxd\fig_3_7-2_Zoning_in_Project_Vicinity.mxd



Legend

Grayson Power Plant Facility Boundary

Utility Operations Center Boundary

Zone Code

- Unknown
- C2 - Community Commercial
- CDP - Commercial Planned Development
- IMU - Industrial/Commercial Mixed Use
- IMU-R - Industrial/Commercial/Residential Mixed Use
- IND - Industrial
- M2 - Heavy Manufacturing
- M3 - Unclassified
- OS - Open Space
- PF - Public Facilities
- R1650 - Medium High Density Residential
- R2250 - Medium Density Residential
- R3050 - Moderate Density Residential
- R1 - Low Density Residential
- SFMU - Commercial/Residential Mixed Use
- SR - Special Recreation
- T - Transportation

Stantec

Grayson Repowering Project

Notes:
1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
2. Park Data- Los Angeles County GIS Database 2017

Figure 4-9
Zoning in the Project Vicinity

Prepared: JTrook, 6/12/2017, Technical Review: MW, Independent Review, SR

Existing noise levels were measured at seven representative sensitive receptors near the Project site on March 23 and 24, 2017, to estimate ambient noise levels in the surrounding environment. As described above, these noise measurements were collected at a time intended to estimate noise levels that would occur without operation of the existing Grayson Power Plant primary noise sources which would be removed as part of the Project. Ambient measurement locations were selected at the nearest sensitive receptors to the Project site, which are primarily the residences located to the east/northeast and across the railway and San Fernando Road and the John Ferraro Athletic Fields across the Los Angeles River.

In accordance with Chapter 8.36 (Noise Control) of the City of Glendale Municipal Code and in consideration of Chapter XI (Noise Regulation) of the City of Los Angeles Municipal Code[11], noise measurements were collected using a sound level meter using the A-weighing positioned close to property line with the microphone located four to five feet above the ground and ten or more feet from the nearest reflective surface where practical. Measurements were collected for minimum of 15-minute continuous intervals during day, evening, and night time periods. These measurement lengths meet or exceed the five-minute criteria identified in Chapter 8.36 (Noise Control) of the City of Glendale Municipal Code and the 15-minute criteria identified in the City of Los Angeles Municipal Code (1973) used to determine ambient noise levels. Ambient noise levels at one location were measured for 25 continuous hours, consistent with that applied by the California Energy Commission for determining ambient noise levels for proposed power plants undergoing their licensing process. The sensitive receptors, proximity to the project site, and the ambient noise level are presented in Table 4-43 below. The locations of the sensitive receptors are shown in Figure 4-10. Receptors 1 through 6 are located in the City of Glendale and Receptor 7 is located within the City of Los Angeles. Ambient noise measurements collection logs are included as Appendix I.

[11] Los Angeles standards are not legally enforceable; however, were considered for disclosure of potential noise impacts.

Table 4-43 Sensitive Receptors and Ambient Noise Levels in Proximity to Project Site

Receptor Identification	Receptor Description	Receptor Location	Ambient Noise Level (Leq)		
			Day	Evening	Night
R1	Residential land use	Residences along Kellogg Ave. Approximately 740 feet northeast of the Grayson Power Plant (across the railway tracks and San Fernando Ave). and intervening commercial uses	54.2	55.3	49.6
R2	Residential land use	Residences along Highland Ave. Approximately 470 feet northeast of the Grayson Power Plant (across the railway tracks and San Fernando Ave). and intervening commercial uses	64.7	61.7	52.8
R3	Residential land use	Residences near Grange St and Dale Ave (particularly those abutting the alley between the mixed use and residential land uses. Approximately 430 feet east of the Grayson Power Plant (across the railway tracks and San Fernando Ave). and intervening commercial uses	57.1	57.2	52.8
R4	Grayson Power Plant Property boundary	Grayson Power Plant exit gate on Flower Street at western property boundary.	68.4	67.8	56.0
R5	Industrial land use	Near corner of Fairmont and Flower St. Approximately 1,200 feet northwest of Grayson Power Plant.	60.5	61.2	57.7
R6	Grayson Power Plant Property boundary	Near the corner of Flower St and Grand Central Ave at the northwestern property boundary.	61.7	58.6	55.6
R7	Recreation land use	East end of John Ferraro Athletic Fields. Approximately 510 feet west of Grayson Power Plant.	60.6	61.8	58.8

Note:
- Data collected by Stantec Personnel on March 23 and 24, 2017.
- Data does not include the abnormal noise events recorded during the survey or the contribution from the existing Grayson Power operation

Document Path: U:\2057\2057123300\mxd\fig 3 7-3 Ambient Noise Measurement Locations.mxd

Legend

Receptor Location

Grayson Power Plant Facility Boundary

Utility Operations Center Boundary

Stantec

Grayson Repowering Project

Figure 4-10
Ambient Noise Measurement Locations

Notes:
1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
2. Park Data- Los Angeles County GIS Database 2017

Prepared: JTrook, 6/12/2017, Technical Review: MW, Independent Review, SR

4.8.2 LAWS, ORDINANCES, REGULATIONS, AND STANDARDS (LORS)

The federal, state and local noise LORS applicable to the Project or adopted for purposes of this noise impact analysis are listed in Table 4-44 and summarized below.

Table 4-44 Laws, Ordinances, Regulations, and Standards (LORS) for Noise

LORS	Administering Agency
Federal	
Federal Noise Control Act of 1972 (40 CFR Part 204)	USEPA
29 CFR 1919.120	OSHA
State	
Government Code Section 65302(g)	California Office of Noise Control
20 CCR Division 2, Appendix B(g)(4)(A)	California Energy Commission
CCR Title 24, California Noise Insulation Standards	California Building Standards Commission
8 CCR Section 5095 et seq.	Cal-OSHA
Local	
General Plan Noise Element	City of Glendale
Noise Ordinance	City of Glendale

Federal

The Federal Noise Control Act regulates noise emissions from operation of construction equipment and facilities; establishes noise emission standards for construction and other categories of equipment and provides standards for testing, inspection, and monitoring of such equipment. It also gives states and municipalities primary responsibility for noise control.

There are no Federal LORS directly regulating offsite (community) noise. Federal regulations applicable to the Amended Project have been incorporated into state and local requirements. USEPA noise guidelines have been considered in developing local requirements.

Federal regulations safeguard the hearing of workers exposed to occupational noise, enforced by OSHA (e.g. 29 CFR 1919.120). For example, it is unlawful for employees to be exposed to noise levels in excess of 115 dBA for more than 15 minutes during any working day. The USEPA has developed guidelines on recommended maximum noise levels to protect public health and welfare. The USEPA identifies a 24-hour exposure level of 70 dBA as the level of environmental noise which will prevent any measurable hearing loss over a lifetime.

State

California State Government Code Section 65302g mandates that noise elements be included as a part of city general plans and that cities adopt comprehensive noise ordinances. The Cities of Glendale and Los Angeles both have noise elements and ordinances which are discussed further below under Local LORS.

According to Cal-OSHA, the standard is set at the noise threshold where hearing loss may occur from long–term exposures. The maximum allowable level is 90 dBA averaged over an eight (8)-hour time period. Standards and implementation are administered by the California Department of Industrial Relations' Division of Occupational Safety and Health (Cal-OSHA) which are based on the USEPA occupational guidelines to protect the hearing of workers. Onsite Project areas above 85 dBA will be posted as high noise level areas and hearing protection will be required in these work areas and the 8-hour exposure levels below 90 dBA will be maintained.

The California Energy Commission (CEC) guidelines state that the area of impact to be studied should include areas where the noise of the project plus the background exceeds the existing background levels by 5 dB(A) or more at the sensitive receptor, including those receptors that are considered a minority population. The CEC has considered it reasonable to assume that an increase in background noise levels up to 5 dBA in a residential setting is considered insignificant, while an increase of more than 10 dBA in a residential setting is considered significant. For projects where the increase is between 5 and 10 dBA, the level of an impact depends on the particular circumstances of a case. Factors to be considered in determining the significance of an impact for this plus 5 to plus 10 dB situation include:

- Resulting noise level;
- Duration and frequency of the noise;
- Number of people affected; and
- Land use designation of the affected receptor sites.

CCR Title 24 establishes a maximum interior noise level of 45 dBA CNEL, with windows closed, due to exterior noise sources, for dwellings other than detached single-family dwellings.

8 CCR Section 5095 et seq. establishes Cal-OSHA employee noise exposure limits. These standards are equivalent to the Federal OSHA standards. Worker noise exposure is limited to 90 dBA over an eight-hour work shift. Areas where worker noise exposure exceeds 85 dBA must be posted as a noise hazard zone and a hearing conservation program is required.

Local

Community noise standards relevant to the Project are contained in the City of Glendale General Plan and Noise Ordinance.

<u>City of Glendale General Plan Noise Element</u>

The City of Glendale General Plan Noise Element (adopted June 7, 2007) specifies outdoor and indoor noise standards for various land uses impacted by transportation noise sources. The City's noise standards are consistent with the State of California's noise standards. The interior and exterior noise standards are set using CNEL scale. The standards state that for residential land use, the exterior noise exposure level shall not exceed 65 CNEL and the interior noise exposure level shall not exceed 45 CNEL. Open space park land has an exterior standard of 65 CNEL for hillside open space areas open to the public. Hotel, motel, transient lodging, church, school classroom, and hospital uses have interior noise limits of 45 CNEL. These levels are also consistent with the land use compatibility guidelines developed by the California Department of Health.

City of Glendale Noise Ordinance

A noise ordinance is designed to control unnecessary, excessive, and annoying sounds from stationary (non-transportation) noise sources. Noise ordinance requirements cannot be applied to mobile noise sources such as heavy trucks when traveling on public roadways. Federal and state laws preempt control of mobile noise sources on public roads. Noise ordinance standards typically apply to industrial and commercial noise sources impacting residential areas.

The City of Glendale Noise Ordinance, located in Chapter 8.36, Section 8.36.040 of the Municipal Code, applies the most stringent exterior noise limits of 55 to 60 dBA Leq, depending on the type of residential, for the daytime period (7:00 A.M. to 10:00 P.M.) and 45 dBA Leq for the nighttime period (10:00 P.M. to 7:00 A.M.) at the nearest residential property. Also, the exterior noise level cannot exceed 65 dBA (Leq) at any time at an adjacent commercial property, and 70 dBA (Leq) at any time at an adjacent industrial property. The noise limits pertain to noise which exceeds the actual (measured noise) versus presumed ambient noise, and are in terms of hourly average (Leq) noise levels. Section 8.36.050 of the City of Glendale's Noise Ordinance specifies that when determining ambient and allowable noise levels, the following applies:

- Where the actual ambient is less than the presumed ambient, the actual ambient shall control and any noise in excess of the actual ambient, plus five dBA, shall be a violation.
- Where the actual ambient is equal to or more than the presumed ambient, the actual ambient shall control and any noise may not exceed the actual ambient by more than five dBA; however, in no event may the actual ambient exceed the presumed noise standards by five dBA.
- At the boundary line between two zones, the arithmetic average of the presumed ambient noise levels shall be used.

Construction activities that take place between 7:00 a.m. and 7:00 p.m. Monday through Saturday, excluding City holidays are consistent with that required by the City of Glendale's Nosie Ordinance. Construction will not be allowed at any time outside these hours and days without a variance issued by the City.

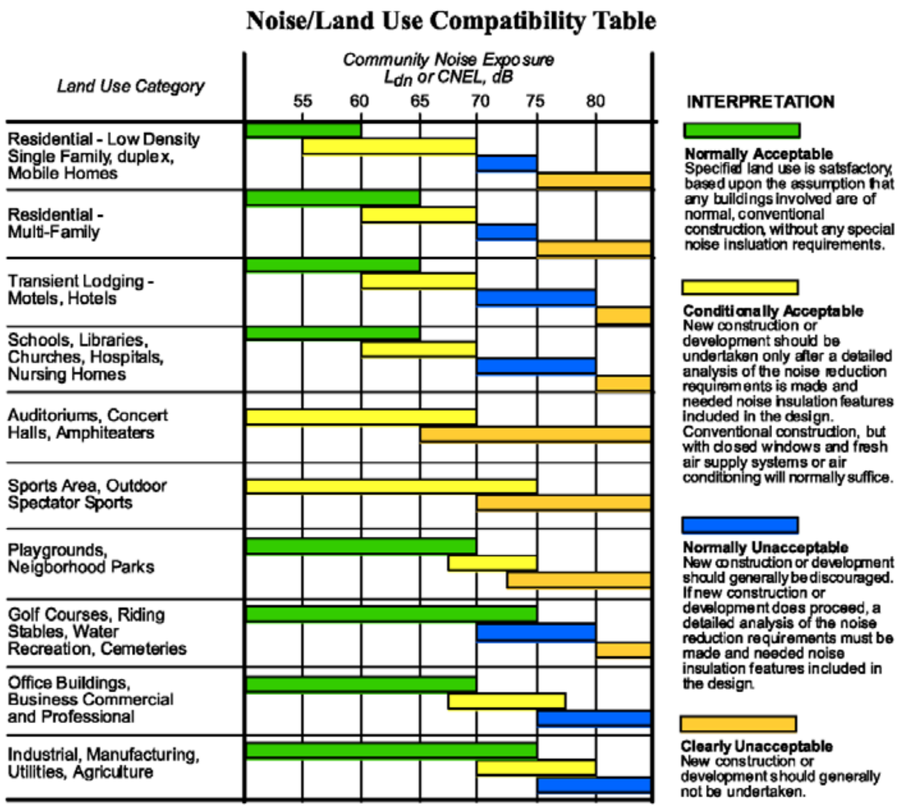
Section 8.36.210 of the Noise Ordinance provides that vibration created by the operation of any device would be a violation of City standards if such vibration were above the vibration perception threshold of an individual at or beyond the property boundary of a source on private property. For sources on a public space or public right-of-way, a violation would occur if the vibration perception threshold of an individual were exceeded at a distance of 150 feet from the source. Under the Noise Ordinance, the vibration perception is presumed to be at 0.01 in/s over the frequency range of 1 Hz to 100 Hz. The Noise Ordinance, however, does not state whether the presumed perception limit represents the peak particle velocity (PPV) or the root-mean-square (RMS) value and does not establish maximum allowable vibration levels during construction activities, where limited options exist to eliminate ground vibration. The presumed perception limit of 0.01 in/s is lower than 0.03 in/s PPV typically used for steady-state vibration perceptibility criterion (e.g. Reiher-Meister chart). Additionally, the background levels of vibration in buildings in urban areas are typically 0.03 in/s or more.

Land Use and Noise Compatibility Matrix

The Cities of Glendale Noise Element contains a compatibility matrices for determining the compatibility of various land uses with noise levels (City of Los Angeles 1999). The matrix shown below is consistent with the California Noise/Land Use Compatibility Guidelines. It classifies various land uses in terms of Normally Acceptable, Conditionally Acceptable, Normally Unacceptable and Unacceptable based on their noise exposure in the Community Noise Equivalent Level (CNEL) scale. For residential uses, CNEL levels from 50 to 60 dB are Normally Acceptable, CNEL levels from 65 to 70 dB are Conditionally Acceptable, CNEL levels of greater than 75 dB are Normally Unacceptable.

A land use exposed to noise levels that are considered Normally Acceptable indicates that the land use is compatible with the noise environment and no special noise insulation is required. If new construction is exposed to a Conditionally Acceptable noise level, a noise analysis is typically required to determine noise mitigation required to reduce noise levels to a compatible level. Conventional construction will normally suffice with a fresh air supply system or air conditioning to allow windows to remain closed. A noise analysis is also required for new construction exposed to a Normally Unacceptable noise level. The analysis is required to determine mitigation measures, which may be significant, to reduce noise levels to a compatible level. Proposed development exposed to Clearly Unacceptable noise levels should generally not be undertaken.

Figure 4-11 Noise Land Use Compatibility Chart



Source: State of Califronia, "General Plan Guidelines," 1998

Low Frequency Noise

There are no applicable regulations that address the Project's low frequency noise (LFN) emissions at either Federal, State, on Municipal level. It is however, well known that excessive amounts of LFN can induce vibrations in building and cause annoyance.

In the absence of regulations, the preferred LFN limits for the Project are defined using guidance in ANSI 12.9 Part 4 standard. -2005/American National S Quantities and Procedures for Description and Measurement of Environmental Sound - Part 4: Noise Assessment and Prediction of Long-Term Community Response. The standard was developed and approved by Accredited Standards Committee S12 Noise under operating procedures accredited by the American National Standards Institute (ANSI) and in coordination with the Acoustical Society of America. ANSI 12.9 is well regarded among noise practitioners. This standard specifies methods to assess environmental sounds and to predict the annoyance response of communities to long-term noise from a variety of environmental sounds. Guidance for assessing sounds with strong low-frequency noise content is provided in Appendix D of the standard.

ANSI 12.9 uses the logarithmic (energy) summation of sound pressure levels in the 16-Hz, 31.5-Hz, and 63-Hz octave bands as single number descriptor for LFN content. The standard advises that generally, annoyance is minimal when sound pressure levels at 16 Hz, 31.5 Hz and 63 Hz are below 65 dB (equivalent LFN of up to 70 dB) and such LFN levels are generally acceptable. Environmental noise with sound pressure levels at 16 Hz, 31.5 Hz and 63 Hz in excess of 75 dB (LFN of up to 80 dB), can result in noticeable noise induced rattles and such LFN noise levels are generally unacceptable. For LFN above 75 dB, ANSI 12.9 advises additional adjustment for increased annoyance from rattles that result when LFN exceeds 75 dB.

4.8.3 ENVIRONMENTAL IMPACTS

4.8.3.1 Methodology

Assessment Methodology

The approach used to assess the potential noise effects during normal operations of the Project is:

1. Define the noise thresholds of significance in accordance with the regulatory requirements framework
2. Create a noise model based on the Project facility's layout and equipment noise emissions as provided by the equipment vendors
3. Predict noise levels at the identified noise sensitive receptors locations
4. Determine cumulative sound levels for the Project at the identified receptors by combining predicted sound levels with the established ambient sound levels
5. Assess compliance of cumulative sound levels with the noise thresholds
6. Assess low-frequency noise
7. Summarize project noise mitigation measures
8. Evaluate the Project's compliance with the regulatory requirements

Thresholds of Significance

<u>Residential Receptors</u>

Thresholds of significance at the residential receptors are provided by the City of Glendale Noise Ordinance. The thresholds of significance represent limits beyond which the exposure of persons to or generation of noise exceeds the standards established in the local general plan or noise ordinance, or applicable standards of other agencies. These limits are specified for daytime and nighttime periods and incorporate the actual measured ambient sound levels.

Conveniently, the thresholds can be used to define the allowed noise contributions from the Project (noise design targets) at the noise sensitive receptors, which in turn, establish limits on noise emissions from the Project.

For residential receptors, nighttime limits as specified in the City of Glendale Noise Ordinance are most stringent. At the same time, the noise emissions from the Project are assumed to be substantially unchanged from daytime to nighttime hours and reflecting full power operating condition. Therefore, the nighttime thresholds define Project noise limits and govern the Project noise control requirements at the residential receptors. The residential area east of San Fernando Road is the area most affected by the project. The area's boundary between R2 and R3 represents the most affected noise sensitive receptors. Project compliance at these receptors will automatically result in compliance at the commercial area along San Fernando Road where noise limits are 10 dB higher. Table 4-45 below shows the summary of Project design targets for the residential noise sensitive receptors.

Table 4-45 Determination of Project Noise Design Targets for the Residential Locations

Receptor	Measured Nighttime Ambient (dBA)	Presumed Nighttime Ambient (dBA)	Cumulative Nighttime Limit (dBA)	Project Noise Design Target (dBA)	
				Based on Measured Ambient	Based on Presumed Ambient
R1	49.6	49.6	54.6	53.0	**53.0**
R2	52.8	50.0	55.0	51.0	**53.4**
R3	52.8	50.0	55.0	51.0	**53.4**

Note:

- Noise design targets reflect the City of Glendale Noise Ordinance and are based on ambient sound level data which excludes the contribution from existing Grayson Power operation.
- The noise targets assume that the Project operates continuously at full power.

The presumed ambient sound levels are derived from the presumed noise standards in the City of Glendale Noise Ordinance and represent the expected noise levels within different designated zones. For low density residential zones, the presumed noise standard and correspondingly the presumed (expected) ambient sound levels are 45 dBA. In most cases the actual ambient sound levels are not equal the presumed ambient sound levels. In such cases the actual ambient sound levels take precedence. The ordinance is however clear, that the actual ambient sound levels may not exceed the presumed noise standard by more than 5 dB. Therefore, for a given area or a group of receptors, the presumed ambient sound levels are set equal to the measured ambient sound level or presumed noise standard plus 5 dB, whichever is lower.

<u>Recreational Receptors</u>

Receptor R7 represents the most affected recreational receptor at the John Ferraro Athletic Fields. Project noise design target can be derived from the threshold using the measured ambient sound levels at R7 and assuming that the Project operation is unchanged throughout any 24-hour period and reflects operation at 100 percent power. Table 4-46 below shows the summary of Project noise design target for John Ferraro Athletic Fields to the west of the Project.

Table 4-46 Determination of Project Noise Design Targets for John Ferraro Athletic Fields

Receptor	Measured CNEL (dB)	Maximum Acceptable CNEL (dB)	Project Only CNEL Limit (dBA)	Allowed Project Contribution (dBA, Leq)
R7	66.0	70.0	67.8	**61.1**

Note:
- Project is assumed to operate continuously under steady state full power condition during the daytime, evening, and nighttime hours.

Vibration Limits

In regard to vibration, the City of Glendale Noise Ordinance relates to operation or permitting to operate any device which creates vibration. The ordinance requires that levels of vibration be below the vibration perception threshold defined as 0.01 in/s.

The Ordinance exempts utility company maintenance and construction operations from its provisions. Therefore, for Project construction activities, the vibration limits are set to minimize the potential that such work causes any structural damage to nearby residential and commercial properties. The tolerable vibration limits are shown in Table 4-47 below. The levels in the Table were derived from the data presented in California Department of Transportation, *Transportation and Construction Vibration Guidance Manual*, September 2013a. For residential locations to the east of the Project the vibration levels should be limited to 0.2 in/s PPV (peak particle velocity). For the commercial properties along the San Fernando Road, the vibration levels should be limited to 0.5 in/s PPV.

Table 4-47 Tolerable Vibration Limits for Selected Types of Structures

Structure and Its Condition	Maximum PPV (in/sec)	
	Maximum Limit (reflects transient sources of vibration)	Preferred Limit Reflects continuous or frequent Intermittent sources of vibration)
Residential structures (gypsum or plastered walls)	0.50	0.20
Modern industrial/commercial buildings	2.00	0.50

Note:
- Limits derived from data presented in Caltrans Construction Vibration Guidance Manual, September 2013.

Computer Modelling

A detailed noise model was built to assess the Project's noise impacts during operation and confirm that the main equipment sound power levels as shown in Tables 4-47, 4-48, and 4-49, and sound power levels specified for auxiliary equipment of Table 4-50 will result in the Project meeting the community noise standards as defined by allowable project noise contributions.

Sound propagation calculations used in this assessment were in accordance with the International Organization for Standardization (ISO) 9613 Part 1 and 2 Standards. ISO 9613 is commonly used among noise practitioners and is generally accepted by the regulatory bodies for the purpose of sound level predictions. Calculations under ISO 9613-2 account for mild inversion and/or downwind condition (winds from source to receiver of 3 to 11 km/h). The calculation parameters are summarized in Table 4-48.

Propagation calculation were performed using Cadna/A (v.4.6.155) computer program from DataKustik, a noise modeling software package incorporating ISO 9613 algorithms.

The model accounted for the following factors:

- Geometric spreading
- Ground absorption
- Screening effects
- Atmospheric absorption
- Noise sources characteristics – type, location, elevations and directivity
- Atmospheric effects of downwind conditions and/or mild temperature inversion

Model Parameters

The modelling parameters used in the assessment are summarized in Table 4-48 below.

Table 4-48 Noise Model Parameters used in Project Noise Impact Assessment

Model Parameters	Model Setting
Temperature	68 °F (20 °C)
Relative Humidity	80 %
Number of reflections	1
Propagation Standard	ISO 9613-1, ISO 9613-2
Ground Conditions and Attenuation Factor	Ground absorption (G) 0.5 over the entire area
Receptor Height	5 feet (1.5 m) above grade
Topography	included
Foliage Attenuation	none

Model Parameters	Model Setting
Operating Conditions	Full Load, 100% Throughout

Meteorological factors, such as temperature, humidity, wind speed and direction, affect sound propagation. Effects of wind and atmospheric stability on outdoor sound propagation during various weather conditions can cause large variations in Project-related sound levels when measured at a receptor location. Upwind sound propagation, or propagation during unstable atmospheric conditions, typically results in lower receptor levels, while downwind conditions and stable atmosphere tends to increase receptor levels. ISO 9613 algorithms used in this assessment simulate downwind propagation under a mildly developed temperature inversion (both of which enhance sound propagation) and provide a reasonably conservative assessment of potential effects.

Prediction Accuracy

Overall prediction accuracy depends on two factors: the accuracy of the noise source data and the accuracy of the sound propagation model.

The sound power levels for major pieces of power generating equipment were provided directly by equipment vendors (Siemens, Peerless). The noise emissions from other sources were limited to reasonable amounts and suitable spectra fitted based on past experience with similar equipment. The noise model was built using vendor plan and elevation drawings.

Overall, the Project source sound power levels are expected to be conservative. The degree of conservatism is related to the margins of safety and tolerances used by the equipment vendors – often between 2 and 5 dB depending on the particular piece of equipment and the octave band in question.

The ISO 9613 sound propagation algorithms have a published accuracy of +/-3 dB over source receiver distances between 100 m and 1000 m. Propagation over shorter distances tends to be more accurate than that over longer distances. The ISO 9613 model also produces results representative of meteorological conditions enhancing sound propagation (e.g., downwind and temperature inversion conditions). These conditions do not occur all the time, therefore, the model predictions are expected to be conservative. Furthermore, to account for the level of uncertainty in the noise predictions, conservative assumptions regarding the Project have been made where practical. These include the assumptions that downwind conditions exist 100 percent of the time or that all equipment operate at full load and 100% throughout during the night.

Major Equipment Noise Emissions

Tables 4-49 and 4-50 below show the equipment component sound power levels for the Industrial Trent 60 and SCC6-800 power generation blocks, respectively, proposed for the Project. The equipment will be supplied by Siemens.

Table 4-49 Sound Power Levels for the Industrial Trent 60 Power Generation Block Equipment Components

Noise Source	Unweighted Sound Power Levels (dB re. 1 pW) at Octave Band Center Frequencies (Hz)									dBA	dBC
	31.5	63	125	250	500	1000	2000	4000	8000		
Trent 60 ASC Fan Opening	98	98	100	92	83	86	87	85	82	**93**	**104**
Trent 60 CAI Filter House Shell	96	95	96	90	78	77	93	96	87	**99**	**103**
Trent 60 CAI Opening	105	103	103	91	79	53	70	85	89	**93**	**109**
Trent 60 Combustion Exhaust (TOS) 90-deg	119	116	113	105	99	90	90	94	75	**103**	**122**
Trent 60 Gas Turbine Enclosure	104	105	108	100	98	84	90	79	77	**99**	**111**
Trent 60 Generator Enclosure (incl. vent)	97	104	105	107	104	101	99	91	84	**107**	**112**
Trent 60 GT Bleed Duct B/O	106	106	103	87	76	71	81	80	81	**90**	**110**
Trent 60 GT Bleed Opening	105	103	99	87	78	73	74	82	89	**98**	**115**
Trent 60 GT Enclosure base	84	88	100	101	88	83	92	78	70	**97**	**104**
Trent 60 GT Enclosure Vent Outlet Duct B/O	111	106	98	93	91	84	80	76	73	**92**	**112**
Trent 60 GT Ventilation Intake	100	98	93	81	77	36	44	46	62	**80**	**103**
Trent 60 GT Ventilation Outlet per side	105	102	99	91	85	78	77	79	85	**90**	**112**
Trent 60 ISI Skid B/O	78	82	77	91	94	80	78	79	70	**92**	**96**
Trent 60 LOC Fin-Fan Total PWL	102	101	100	97	92	90	84	78	72	**95**	**107**
Trent 60 Mineral LO Skid	79	79	80	82	82	85	82	78	72	**89**	**91**
Trent 60 SCR Body 1	113	110	101	84	74	68	67	58	49	**89**	**118**
Trent 60 SCR Body 2 (incl. Transition 3)	110	107	97	80	70	64	63	55	46	**86**	**115**
Trent 60 SCR Stack - Total PWL	113	107	99	81	71	65	65	61	50	**90**	**124**
Trent 60 SCR Transition T1	113	109	101	87	78	72	71	63	54	**90**	**120**
Trent 60 SCR Transition T2	114	110	102	88	79	73	72	64	55	**91**	**121**
Trent 60 Temp Air Blower (inlet+case+motor+duct)	89	88	90	94	91	89	86	82	78	**94**	**99**
Trent 60 Water Injection Skid B/O	92	80	82	90	88	85	86	82	69	**92**	**96**
Note: The equipment sound power levels shown in this table have been provided and confirmed by Siemens.											

Table 4-50 Sound Power Levels for the SCC6-800 Power Generation Block Equipment Components

Noise Source	Unweighted Sound Power Levels (dB re. 1 pW) at Octave Band Center Frequencies (Hz)									dBA	dBC
	31.5	63	125	250	500	1000	2000	4000	8000		
STG-800 Ammonia Skid	103	106	97	88	70	56	52	54	63	**85**	**107**
STG-800 CAI Filer Face Opening + Case	99	102	101	106	88	73	84	103	92	**105**	**109**
STG-800 Exhaust Duct (total)	113	112	111	100	89	83	85	84	88	**98**	**116**
STG-800 Generator Enclosure	100	102	113	96	85	77	77	62	55	**98**	**113**
STG-800 GT Enclosure	111	113	112	98	96	93	98	95	84	**103**	**116**
STG-800 GT Enclosure Ventilation Discharge	111	111	115	103	93	93	91	90	90	**102**	**117**
STG-800 GT Ventilation Fan Casing	104	104	107	107	105	100	94	86	79	**106**	**112**
STG-800 GT Enclosure Ventilation Inlet	95	97	98	86	81	80	87	87	83	**93**	**101**
STG-800 HRSG Body (total, incl. SCR)	111	103	103	92	80	82	78	73	63	**90**	**110**
STG-800 HRSG Combustion Exhaust, 90 deg	104	99	102	94	86	89	80	76	66	**93**	**106**
STG-800 HRSG Inlet Expansion Joint	79	77	61	73	72	78	70	69	63	**80**	**83**
STG800 HRSG Outlet Duct	97	88	87	75	62	61	48	41	24	**73**	**96**
STG-800 HRSG Outlet Flex Joint	65	60	73	74	55	60	41	33	26	**67**	**77**
STG-800 HRSG Stack B/O (total)	105	96	99	89	79	77	60	46	29	**86**	**104**
STG-800 HRSG Transition 1	110	95	94	86	80	83	82	77	67	**88**	**107**
STG-800 HRSG Transition 2	109	97	96	86	78	81	80	75	65	**87**	**107**
STG-800 Oil Mist Vent Outlet	84	85	84	81	81	79	71	63	57	**83**	**90**
Note: The equipment sound power levels shown in this table have been provided and confirmed by Siemens.											

The sound power levels shown in Tables 4-49 and 4-50 have been confirmed by Siemens and can be used in acoustic analysis.

In addition to Industrial Trent 60 and SCC6-800 equipment shown above, Siemens will supply steam turbines (SST-400), TEWAC (Totally Enclosed Water to Air Cooled) steam turbine generators, and associated equipment. The sound power levels for this equipment are shown in Table 4-52. This equipment will be placed in the steam turbine building.

Table 4-51 Sound Power Levels for SST-400 Steam Turbine Equipment Components and other Sources within the Steam Turbine Building

Noise Source	Unweighted Sound Power Levels (dB re. 1 pW) at Octave Band Center Frequencies (Hz)									dBA	dBC
	31.5	63	125	250	500	1000	2000	4000	8000		
SST-400 Steam Turbines	104	116	107	103	95	92	89	88	81	**100**	**116**
ST Gearboxes	123	139	117	105	94	87	86	82	79	**113**	**138**
ST Generators (TEWAC)	106	118	115	106	92	88	85	80	72	**102**	**119**
Instrument Air Compressors	95	101	97	96	100	97	97	101	99	**106**	**108**
Condenser Pumps	101	101	98	96	97	101	92	89	80	**103**	**106**
Bldg Ventilation Components	99	102	105	103	102	98	96	91	87	**104**	**110**
Steam Pipe Rack	91	95	97	98	102	98	91	90	83	**102**	**106**

Note:
The equipment sound power levels shown in this table for steam turbine, gear box and steam turbine generator have been provided by Siemens. The sound power levels for the other sources have been estimated by Stantec and are based on Stantec's experience.

The data for steam turbines, gearboxes, steam and steam turbine generators as shown in Table 4-51 has been provided by Siemens, but not yet confirmed. Should these levels be confirmed, additional low frequency noise control for the gearbox may be provided to achieve the LFN targets at the noise-sensitive residential receptors. Data for the remaining equipment within the steam turbine building is estimated and based on previous experiences.

Auxiliary Equipment Noise Emissions

Table 4-52 below shows the sound power levels for the auxiliary equipment of the Project. The data shown in the table reflects the information in the noise management plan prepared for the Engineering, Procurement, and Construction (EPC) contractor. The noise emission for the equipment selected for the Project will not exceed the levels shown in the Table 4-52. The values shown in Table 4-52 reflect the noise control requirements summarized in Table 4-53.

Table 4-52 Sound Power Levels for Auxiliary Equipment Components

Noise Source	Unweighted Sound Power Levels (dB re. 1 pW) at Octave Band Center Frequencies (Hz)									dBA	dBC
	31.5	63	125	250	500	1000	2000	4000	8000		
Water Treatment Building	89	88	91	92	89	88	82	77	71	**92**	**98**
Steam Turbine Building	112	114	105	90	76	70	63	61	54	**92**	**115**
Steam Pipe Rack (in the yard, per 1 meter)	71	75	77	78	82	78	71	70	63	**82**	**86**
Fuel Gas Compressor (incl. motor)	108	109	111	106	103	101	99	98	97	**107**	**115**
Fuel Gas Cooler	106	107	104	102	99	93	90	85	82	**100**	**111**
Cooling Tower Fan Discharges (per fan, 90-deg)	100	107	106	103	98	93	86	78	69	**102**	**110**
Cooling Tower Wet Inlet (water splash + fan noise)	105	109	107	103	97	97	96	98	97	**104**	**113**
Cooling Tower Plenum	109	111	109	105	96	91	82	76	72	**100**	**115**
Cooling Tower Fan Stack B/O noise	105	106	104	101	92	85	78	70	61	**96**	**110**
Cooling Tower Fan Motors (100 hp, less than 85 dBA @ 1m)	82	85	88	90	93	93	92	87	79	**97**	**99**
Boiler Feed Water Pump(s) - unenclosed	100	104	105	97	101	100	99	96	90	**105**	**110**
Recirculation Water Pump(s)	99	99	96	94	95	99	90	87	78	**101**	**105**
GT Generator Transformer (60 MVA, std, NEMA 76.)	92	98	100	95	95	89	84	79	72	**95**	**103**
ST Generator Transformer (30 MVA, std, NEMA 73))	87	93	95	90	90	84	79	74	67	**91**	**99**
Auxiliary Transformers (4 kVA)	83	83	85	85	83	75	68	61	54	**83**	**91**

Note:
- The water treatment and the Steam turbine building sound power levels are overall and based on composite STC ratings for the building envelopes of 24 and 40 respectively.
- Fuel gas compressor and fuel gas cooler levels do not include the effect of the sound barrier considered for these sources as outlined in Table 4.7-13.
- Cooling tower discharges (fan stacks) include 90-degree directivities.
- Sound power levels shown for transformers reflect standard transformers.

Summary of Specific Noise Mitigation Measures

Table 4-51 provides the summary of noise controls and noise emissions limits for the equipment that is not yet selected and thus not covered by vendor guaranties. The limits shown in Table 4-50 are reflected in the values presented in Table 4-49 used in the noise model.

For fuel gas compressors, the required noise limit of 41 dBA at 400 feet can be achieved with either enclosures or acoustic barriers. This assessment considers the use of noise barriers as shown in Table 4-52. Correspondingly, the sound power levels for these sources listed in Table 4-53 are unsilenced.

Table 4-53 Summary of Required Noise Control Measures

Noise Source	Required Noise Control Measure
Cooling Towers	The noise emissions from each cooling towers shall be limited to 57 dBA at 400 feet (107 dBA sound power level). Mats may be required to limit the water splash noise.
Cooling Tower Fan Motors and Gearboxes	The sound power levels for cooling tower motors shall be limited to 98 dBA (85 dBA @ 3') the motors shall be placed on the west side of the towers.
Fuel Gas Compressors	The noise emissions from each cooling towers shall be limited to 41 dBA at 400 feet in order to meet the required noise targets. Compressor enclosures or properly designed noise barrier can be utilized. Under the current assessment scenario open air packages with total sound power level of 108 dBA were treated with 21-foor sound barrier to yield appropriate results.
Water Treatment Building	The noise break-out from the water treatment building shall be limited to 42 dBA at 400 feet. It is expected that this level can be achieved with a building envelope (walls, roof, access doors, equipment doors, ventilation openings) having a composite transmission loss rating of (Sound Tansmission Class) STC 24 or higher
Boiler Feed Water Pumps for SCC6-800 Blocks	The sound power levels for boiler feed water pumps shall be limited to 105 dBA when placed outside near the respective HRSGs.
Recirculation Water Pumps for Cooling Towers	The sound power levels for boiler feed water pumps shall be limited to 101 dBA when placed outside near the respective cooling towers.
GT Generator Transformers	Standard National Electrical Manufacturers Association (NEMA) 76 rated 60 MVA transformers or equivalent shall be utilized.
ST Generator Transformers	Standard NEMA 73 rated 30 MVA transformers or equivalent shall be utilized.
Steam Turbine Building	The sound power level of the noise breaking out from the steam turbine building shall be limited to 95 dBA and 115 dBC (45 dBA and 65 dBC at 400 feet). Currently, very high noise emission levels are specified for gear boxes supplied by Siemens, particularly at 31.5 and 63-Hz octave bands. Suitable noise mitigation will require specialized enclosures for the gearboxes and steam turbine building walls and roofs having an STC 40 composite transmission loss rating.
Steam Pipe Rack	The sound power level for the steam pipe rack shall be limited to 82 dBA per meter of piping
Stem Blowdowns	Steam blowdowns shall be equipped with silencers to limit their noise emissions to 115 dBA sound power (approximately, 90 dBA @ 5')

Ground Vibration from Project Demolition and Construction Activities

Preliminary screening of ground vibration from the Project construction and demolition activities can be performed using the data shown in Table 4-54 below. The data in the table below can be extrapolated to other locations using the formula in California Department of Transportation,

Transportation and Construction Vibration Guidance Manual, September 2013a and conservatively applying the attenuation exponent of 1.1.

Table 4-54 Vibration Data for Common Construction Equipment

Construction / Demolition Equipment		PPV at 25 feet (in/s)
1.5-Ton Ball, 10-ft drop		3.890
Pile Driver (impact)	Upper range	1.518
	typical	0.644
Pile Driver (sonic)	upper range	0.734
	typical	0.170
Pavement Breaker (6-ft drop)		0.420
2.0-Ton Ball, 4-ft drop		0.215
Clam shovel drop (slurry wall)		0.202
Hydromill (slurry wall)	in soil	0.008
	in rock	0.017
Vibratory Roller		0.210
Hoe Ram		0.089
Large bulldozer		0.089
Caisson drilling		0.089
Trucks		0.073

Note: the data in the table is based on the following publications:

- Transit Noise and Vibration Impact Assessment, Federal Transit Authority, U.S. Department of Transportation, (Washington, DC., 2006) Hanson, Towers, and Meister.
- Wiss, John F. et al. 1981. Construction vibrations: State-of-the-art. Journal of the Geotechnical Engineering Division, American Society of Civil Engineers, Vol. 107, Issue 2.

4.8.4 PROJECT IMPACTS

Threshold: Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies

Demolition/Construction

Demolition and construction would result in noise from the operation of conventional construction equipment and associated vehicles. Demolition and construction related activities would typically be limited to Monday through Saturday between the hours of 7:00 a.m. and 7:00 p.m. consistent with the City of Glendale noise ordinance related to construction noise. It is possible that some pouring of concrete for large foundations due to the need to have one continuous pour may be conducted outside these typical construction hours. Smaller foundations would be poured during normal work hours. Construction activities proposed outside the typical hours and days, if necessary, would require and be conducted in accordance with a variance issued by the City of Glendale.

The potential noise levels associated with pouring concrete at night was modeled to determine if resulting noise levels would exceed the City's nighttime noise level standards. It was assumed that concrete pours would consist of operating four concrete mixer/pump trucks simultaneously. The results of the nighttime concrete pouring noise modeling are presented below in Table 4-55

Table 4-55 Summary of Project Construction (Concrete Pouring) Noise Effects at Residential Locations During the Nighttime

Receptor	Measured Nighttime Ambient (dBA)	Presumed Nighttime Ambient (dBA)	Cumulative Nighttime Limit (dBA)	Project Noise Design Target (dBA)	
				Based on Measured Ambient	Based on Presumed Ambien
R1	49.6	49.6	54.6	53.0	**53.0**
R2	52.8	50.0	55.0	51.0	**53.4**
R3	52.8	50.0	55.0	51.0	**53.4**

Note:

- the above noise design targets for operations reflect the City of Glendale Noise Ordinance
- the ambient sound levels are averages over the measurement period and exclude the contribution from existing Grayson Power operation.
- the Project operates continuously at full power throughout the entire nighttime.

As shown in Table 4-55, nighttime construction noise from pouring concrete would be below the applicable City nighttime noise level limits at the nearest residential receptors modeled (R1 noise construction noise level of 53.0 dBA compared to a significance threshold of 54.6 dBA, R2 noise construction noise level of 53.4 dBA compared to a significance threshold of 55.0 dBA, and R3 noise construction noise level of 53.4 dBA compared to a significance threshold of 55.0 dBA). Considering the Projects consistency with the City's noise ordinance and noise from nighttime concrete pouring being below applicable noise levels thresholds, construction related noise would not expose persons to or generate noise levels in excess of established standards and potential impacts would be less than significant. However, conducting concrete pours at night would be subject to a variance issued by the City. The potential for ground borne vibration during construction is discussed further below.

Operation

<u>Residential Noise Levels</u>

Sound level predictions for the Project operation were performed using equipment sound power levels as shown in Tables 4-49, 4-50, noise control guidance in Table 4-53 and corresponding sound power levels of Table 4-52, and the previously described modelling methodology. Noise effects from operation are summarized in Table 4-56 and Table 4-57 for the nighttime and daytime periods respectively. The results are presented for R2 – the most affected location along the noise sensitive residential zone boundary R2-R3 as well as the other two surveyed receptors R1 and R3 – also significantly impacted. The post-construction compliance assessment, if required, can be performed at any of the three locations.

Table 4-56 Summary of Project Operation Noise Effects at Residential Locations During the Nighttime

Receptor	Predicted Operational Noise (dBA)	Operational Noise Design Limit (dBA)	Nighttime Ambient Sound Levels (dBA)		Cumulative Nighttime Operational Noise (dBA)		Community Noise Standard for Nighttime (dBA)
			Measured	Presumed	Measured Ambient	Presumed Ambient	
R1	**51.0**	**53.0**	49.6	49.6	53.4	53.4	**54.6**
R2	**53.1**	**53.4**	52.8	50.0	**56.0**	54.8	**55.0**
R3	**52.6**	**53.4**	52.8	50.0	**55.7**	54.5	**55.0**

Note:
- the above noise design targets for operations reflect the City of Glendale Noise Ordinance
- the ambient sound levels are averages over the measurement period and exclude the contribution from existing Grayson Power operation.
- the Project operates continuously at full power throughout the entire nighttime.

Table 4-57 Summary of Project Operation Noise Effects at Residential Locations During the Daytime

Receptor	Predicted Operational Noise (dBA)	Operational Noise Design Limit (dBA)	Daytime Ambient Sound Levels (dBA)		Cumulative Dayime Operational Noise (dBA)		Community Noise Standard for Daytime (dBA)
			Measured	Presumed	Measured Ambient	Presumed Ambient	
R1	**51.0**	**53.0**	54.4	54.4	56.0	56.0	**59.4**
R2	**53.1**	**53.4**	64.2	60.0	64.5	60.8	**65.0**
R3	**52.6**	**53.4**	57.1	57.1	58.4	58.4	**62.1**

Note:
- the above noise design targets for operations reflect the City of Glendale Noise Ordinance
- the ambient sound levels are averages over the measurement period and exclude the contribution from existing Grayson Power operation.
- The Project operates continuously at full power throughout the entire daytime.

The results in Table 4-54 show that noise design targets are met with the equipment noise emissions as shown in Tables 4-49, 4-50, and 4-52. Additionally, the community noise standards for the nighttime periods (55 dBA or less) are essentially met with slight potential exceedances (1 dB) in some locations along the most sensitive residential zone boundary. These exceedances are primarily due to the actual ambient sound levels being higher than the maximum permitted presumed ambient sound levels. When the presumed ambient levels are used, compliance with the community noise standards is achieved.

Nighttime ambient sound levels vary from hour to hour. At R3, where the 25-hour survey was conducted, the lowest hourly ambient Leq were 48.5 dBA and 48.9 dBA recorded between 2:00

and 3:00 a.m. 3:00 and 4:00 a.m. respectively. The highest hourly nighttime Leq were 56.0 and 56.9 dBA recorded between 10:00 and 11:00 p.mp 6:00 and 7:00 a.m., respectively. It is observed, that during the quietest observed nighttime periods, the Project noise contribution under full operating load and under atmospheric conditions favorable to noise propagation, exceeds the observed ambient sound levels by less than 4 dB. When compared to the overall (9-hour) nighttime period, the Project noise contribution is approximately equal to the ambient sound levels.

The results in Table 4-57 show the community noise standards for the daytime periods are met at all residential receptors.

Table 4-58 below shows the summary of the low-frequency noise impact. Area around R2 is the most impacted residential receptor in regard to low-frequency noise. As seen from Table 4.58, measured low-frequency noise content in the ambient sound is considerably lower than the predicted levels. Therefore, ambient sound levels do not affect low-frequency noise impact.

Table 4-58 Summary of Project Low Frequency Noise Effects at Residential Locations

Receptor	Predicted LFN from Operations (dB)	Preferred LFN Limit (dB)	Measured Nighttime Ambient LFN (dB)	Cumulative Nighttime LFN (ambient + operations) (dB)
R1	**71.7**	**75.0**	59.7	72.0
R2	**74.6**	**75.0**	61.0	74.8
R3	**73.5**	**75.0**	61.0	73.7

Note:

- the above LFN design targets for operations are derived from information in ANSI 12.9-4
- the ambient sound levels are averages over the measurement period and exclude the contribution from existing Grayson Power operation.
- Predicted LFN assume that sound intensities in 16-Hz and 31.5-Hz octave bands are the same
- The Project operates continuously at full power throughout the entire nighttime.

The predicted low-frequency noise levels comply with the recommended limits. All reasonable efforts will be made to further reduce and minimize low-frequency noise and ensure that the design limits are complied with.

The above results presented in Tables 4-56, 4-57, and 4-58 are based on limits to emissions from various noise sources as summarized in Table 4-53. The current selections of the acoustic performance of the steam turbine building, water treatment building, and the sound barrier for the selected fuel gas compressors facilitated the required noise limits. Without such limits the Project could considerably exceed the thresholds and result in potentially significant impacts. It should be noted however, that subsequent to the final equipment selection, the noise controls may be rebalanced and a somewhat different mix of noise source limits may be implemented.

Recreational Noise Levels

R7 represents the most affected recreational receptor at the John Ferraro Athletic Fields. Table 4-59 shows the summary of noise effects at that receptor.

Table 4-59 Summary of Project Noise Effects at the Recreational Location

Receptor	Predicted Sound Level from Operations (dBA)	Operational Noise Design Limit (dBA)	Cumulative CNEL (ambient + operations) (dB)	Maximum Acceptable CNEL (dB)
R7	**57.5**	**61.4**	68.2	**70.0**

Note:

- the above design limit for operations is derived from CNEL limit of 70 dB
- The cumulative CNEL for operations combines measured ambient CNEL of 66.0 dB with Project only CNEL of 64.1 dB.
- The Project operates continuously at full power and constant noise contribution throughout the entire 24-hour period.

As seen from Table 4-59, Project's noise emissions are in compliance at the recreational receptors. Post-construction sound survey at the recreational receptor is not required.

Level of Significance before Mitigation

Potentially Significant

The level of significance before mitigation shown in Table 4-53 was classified as potentially significant. This classification was made because, with the exception of the power equipment supplied by Siemens, the final selection for the remaining equipment is not yet known. It is entirely possible that without the noise limits advised in Table 4.53, the final equipment selected for the project could result in the Project exceeding the noise design targets and effecting significant noise impacts. The noise mitigation measures described below represent limits on noise emissions from equipment and Project components that are not part of Siemens supply. These limits are reasonable and can be practically accommodated.

Mitigation Measures:

NOI-1: Noise Source and Required Noise Control Measures: Cooling Towers - The noise emissions from each cooling tower shall be limited to 57 dBA at 400 feet (107 dBA sound power level). Mats may be required to limit the water splash noise.

NOI-2: Noise Source and Required Noise Control Measures: Cooling Tower Fan Motors and Gearboxes - The sound power levels for cooling tower motors shall be limited to 98 dBA (85 dBA at 3') the motors shall be placed on the west side of the towers.

NOI-3: Noise Source and Required Noise Control Measures: Fuel Gas Compressors - The noise emissions from each of the two fuel gas compressor areas shall be limited to 44 dBA at 400 feet. Compressor enclosures or properly designed noise barriers can be utilized.

Under the current assessment scenario open air compressor equipment packages with total sound power level of 108 dBA were treated with 21-foot sound barrier to yield appropriate results.

NOI-4: Noise Source and Required Noise Control Measures: Water Treatment Area - The noise emissions from the water treatment area shall be limited to 48 dBA at 400 feet. It is expected that this level can be achieved through a combination of equipment selection, small enclosures and barriers

NOI-5: Noise Source and Required Noise Control Measures: Boiler Feed Water Pumps for Combined Cycle Units - The sound power levels for boiler feed water pumps shall be limited to 105 dBA when placed outside near the respective HRSGs.

NOI-6: Noise Source and Required Noise Control Measures: Circulating Water Pumps for Cooling Towers - The sound power levels for circulating water pumps shall be limited to 101 dBA when placed outside near the respective cooling towers.

NOI-7: Noise Source and Required Noise Control Measures: Generator Step-up Transformers - Standard NEMA 95 MVA rated transformers or lower shall be utilized.

NOI-8: Noise Source and Required Noise Control Measures: Steam Turbine Building - The sound power level of the noise breaking out from the steam turbine building shall be limited to 95 dBA and 115 dBC (45 dBA and 65 dBC at 400 feet).

Specialized enclosures for the gearboxes shall be required and steam turbine building walls and roofs shall have an STC 40 composite transmission loss rating.

NOI-9: Noise Source and Required Noise Control Measures: Steam Pipe Rack - The sound power level for the steam pipe rack shall be limited to 82 dBA per meter of piping.

NOI-10: Noise Source and Required Noise Control Measures: Steam Sky vents and safety valves - Steam sky and safety valves shall be equipped with silencers to limit their noise emissions to 115 dBA sound power (approximately, 90 dBA at 5').

Level of Significance after Mitigation:

Less than Significant with Mitigation Incorporated.

Threshold: Exposure of persons to or generation of excessive ground borne vibration or ground borne noise levels

No significant vibration or ground-borne noise effects are expected during the construction or operation of the Project. Project vibration levels beyond the Project site boundary during operations are expected to be negligible. The operational vibration levels are expected to be well below the City of Glendale presumed perception limit of 0.01 in/s anywhere outside of the Project site boundary and as such, are not expected to be detectable.

Demolition and construction activities are expected to involve potential sources of ground borne vibration such as pile driving. At the higher end of the diesel pile drivers, the expected vibration amplitude is 1.52 in/s PPV (see Table 4-54). For demolition activities, the vibration levels equivalent to 1.5-ton ball drop from 10' can be used (3.89 in/s PPV at 25 feet). The nearest commercial structures are located at approximately 330 feet from the expected activities and the nearest residential structure is located at some 440 feet. The construction vibration impact assessment is summarized in Table 4-60 below and the demolition vibration impact assessment is shown in Table 4-61.

Table 4-60 Assessment of Construction Vibration Impacts

Structure	Maximum Expected Construction Vibration PPV (in/s)	Preferred Vibration Limit PPV (in/s)
Nearest Residential Building	0.07	0.20
Nearest Commercial Building	0.09	0.50

Note:
- The predicted values are based on vibration level of 1.52 in/s at 25 feet and using the attenuation exponent of 1.1

Table 4-61 Assessment of Demolition Vibration Impacts

Structure	Maximum Expected Construction Vibration PPV (in/s)	Preferred Vibration Limit PPV (in/s)
Nearest Residential Building	0.17	0.20
Nearest Commercial Building	0.22	0.50

Note:
- The predicted values are based on vibration level of 3.89 in/s at 25 feet and using the attenuation exponent of 1.1

Predicted maximum demolition and construction vibration levels are below the preferred vibration thresholds. The Project would therefore not result in exposure of persons to or generation of excessive ground borne vibration or ground borne noise levels nor would damage to the nearby structures would be expected. Potential impacts are less than significant.

Level of Significance before Mitigation:

Less than Significant

Mitigation Measures:

None necessary

Level of Significance after Mitigation:

Less than Significant

Threshold: A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project

Overall, the Project noise results in a permanent increase in area ambient sound levels of less than 2.5 dB during nighttime hours and less than 1 dB during the daytime hours. The change in the ambient sound level should be barely perceptible. Table 4-62 shows the summary of predicted increases in ambient sound levels.

During the ambient sound survey, the existing Grayson facility was substantially inoperational with only a minimal amount of pieces of equipment running. Correspondingly, the current ambient sound levels do not reflect the full operation of the facility and are thus understated. It is therefore expected that the actual change in the area ambient sound levels will be lower than that predicted in Table 4-62.

Table 4-62 Expected Permanent Changes in the Ambient Noise Levels due to Project

Receptor	Predicted Operational Noise (dBA)	Daytime Ambient Sound Levels (dBA)			Nighttime Ambient Sound Levels (dBA)		
		Current	New	Increase	Current	New	Increase
R1	51.0	55.0	56.0	**1.0**	51.1	53.4	**2.3**
R2	53.1	64.4	64.5	**0.1**	54.3	56.0	**1.7**
R3	52.6	57.6	58.4	**0.8**	54.0	55.7	**1.7**
R7	57.5	61.7	62.5	**0.8**	60.1	61.2	**1.2**

Note:

- Current ambient sound levels (daytime and nighttime) are averages over the measurement period and exclude the abnormal noise events recorded during the survey. Contribution from existing limited Grayson Power operation was not excluded.
- New ambient sound levels included the current ambient sound levels less the existing Grayson Power operation plus Project
- The Project operates continuously at full power throughout the entire daytime.

Level of Significance before Mitigation:

Less than Significant Impact

Mitigation Measures:

No mitigation is required

Level of Significance after Mitigation:

Less than Significant Impact

Threshold: A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project

A substantial temporary increase in ambient noise levels may result from the demolition and construction activities associated with the project. Such increases will fluctuate with changing activities and will thus to a certain extent be intermittent. Some of the noisiest activities, such as pile driving will be relatively short term. Most of the noise sources associated with the existing operation will be removed. This should provide a considerable off-set for the construction and demolition noise effects at the nearby residential receptors.

It should be pointed out that the current construction schedule calls for construction work to be done during the daytime hours of 7:00 a.m. to 7:00 p.m. Correspondingly, construction and demolition noise is will comply with the City of Glendale Noise Ordinance. However, to the extent that is feasible and practical, the contractor will limit the noise effects from construction and demolition activities to between 65 and 70 dBA Leq during the daytime hours. Some activities may intermittently the 65 and 70dBA Leq levels. Overall, the temporary increase in ambient noise levels from demolition and construction actives will have a less than significant impact because a discussed in this Section 4.8, thresholds for Project construction and operation will not be exceeded.

Level of Significance before Mitigation:

Less than Significant Impact.

Mitigation Measures:

No mitigation is required.

Level of Significance after Mitigation:

Less than Significant Impact.